

Missouri Department of Natural Resources

Total Maximum Daily Load Information Sheet

Big River and Flat River Creek

Waterbody Segment at a Glance:

County: St. Francois/Jefferson
Nearby Cities: Leadwood to Eureka
Length of impairment: Big River - 93 miles
Flat River Creek – 5 miles
Pollutants: Lead, Nonvolatile Suspended Solids (NVSS)
Source: Old Lead Belt Abandoned Mine Land

Pollutant 2: Zinc (Flat River Creek only)
Source 2: Elvins tailings pile



State map showing location of watershed

Note: Changes made in the proposed 2002 303(d) listing (detailed on next page)

TMDL Priority Ranking: High

Description of the Problem

Beneficial uses of Big River and Flat River Creek:

- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life and Human Health associated with Fish Consumption.

Use that is impaired

- Protection of Warm Water Aquatic Life

Standards that apply

- Missouri Water Quality Standards for metals found in 10 CSR 20-7.031(4)(B)1 state:
Water contaminants shall not cause the criteria in Tables A and B to be exceeded.
Concentrations of these substances in bottom sediments or waters shall not harm benthic organisms and shall not accumulate through the food chain in harmful concentrations, nor shall state and federal maximum fish tissue levels for fish consumption be exceeded.
- The numeric standards for lead and zinc are dependent on the hardness of the water. The lead standard that applies in these waterbodies is 23 micrograms per liter (μL) at a hardness of over 200. At the same hardness, the zinc standard is 433 μL . These are listed in Table A of the WQS.
- Standards for nonvolatile suspended solids (NVSS) can be found in the general criteria section of the WQS, 10 CSR 20-7.031(3)(A) and (C) where it states:

- Waters shall be free from substances in sufficient amounts to cause the formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses.
- Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor or prevent full maintenance of beneficial uses.

Changes in listing

- The sediment pollutant was changed to nonvolatile suspended solids (NVSS) for both waterbodies
- Length of the zinc impairment in Flat River Creek was increased from 4.5 to 5 miles
- Elvins tailings pile was added as a source of the lead and NVSS impairments in Flat River Creek.

Flat River Creek is a tributary to Big River and their problems are intertwined. Erosion of lead tailings in the Old Lead Belt of St. Francois County in and around these waterbodies has occurred over many decades. This erosion has resulted in a large amount of sediment being deposited in pools within these streams. The sediment (or nonvolatile suspended solids) reduces the aquatic habitat quality by smothering natural substrates (materials in the streambed). Aquatic invertebrate animals (water insects and crayfish) and fish eggs are also smothered.

The impairment is being changed for the new 303(d) list from sediment to Non-Volatile Suspended Solids (NVSS). NVSS results from soil erosion or erosion of mine waste materials or stockpiles (usually silt, sand or gravel). The new listing gives a clearer picture of the specific pollutants affecting the water.

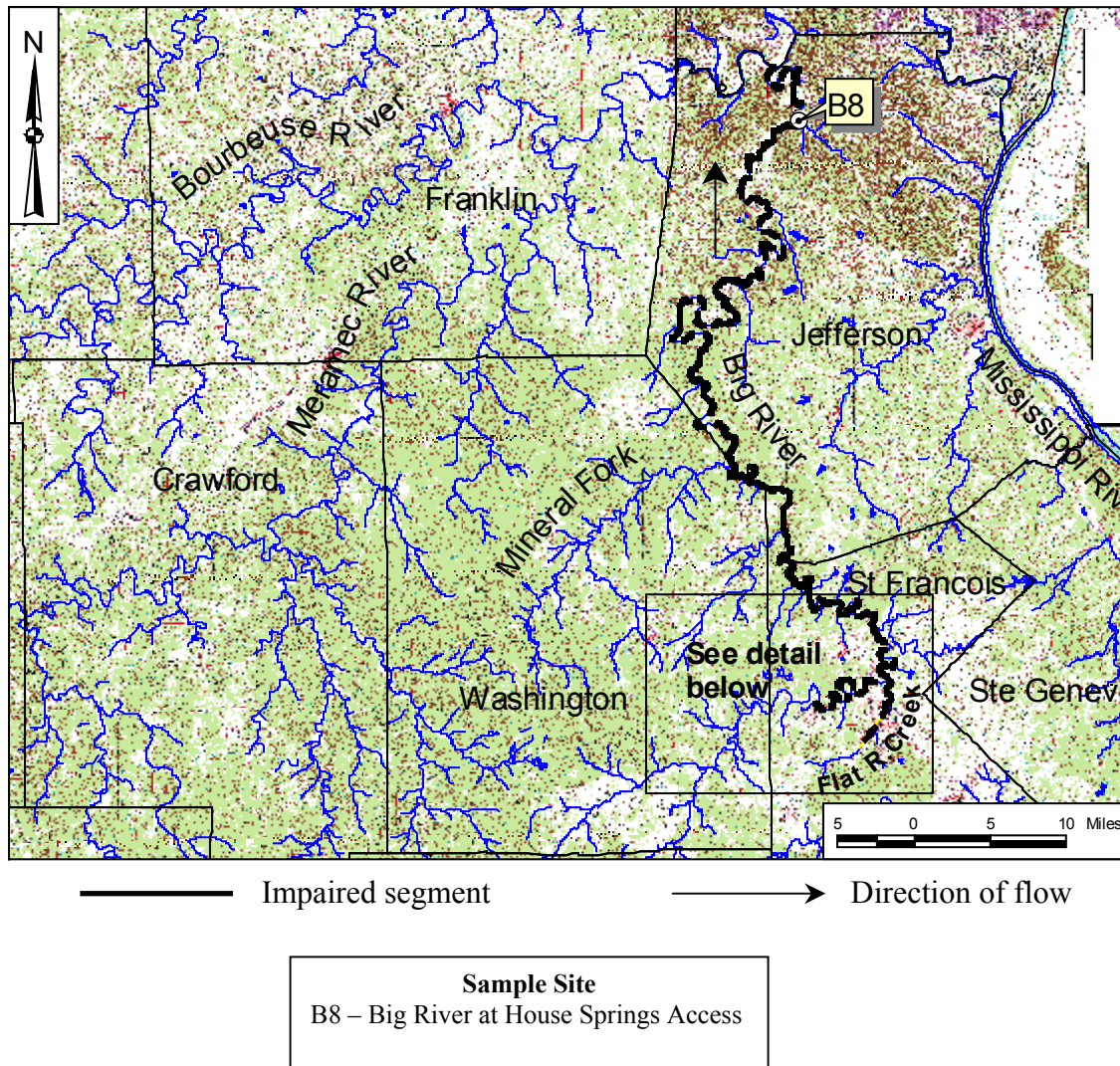
Fish and other aquatic life have accumulated elevated levels of lead in their bodies due to dissolved lead draining from the old tailings. Ninety-three miles of Big River, from Leadwood to the river's mouth, and the lower six miles of Flat River Creek presently are under a Missouri Department of Health Advisory recommending no consumption of sunfish, carp or suckers due to lead contamination of these fish. In humans, lead primarily affects the nervous system, blood cells, and processes for the metabolism of Vitamin D and calcium. Lead can affect the developing fetus during pregnancy and cause lower IQ scores, poor attention levels; hearing, speech and language problems; reading disabilities; reduced motor skills and poor hand-eye coordination. Evidence suggests that lead toxicity may occur at levels as low as 10-15 micrograms per deciliter (µg/dL) of blood. According to the Missouri Department of Health and Senior Services, 11% of the children in St. Francois County tested for blood lead levels actually have lead poisoning.

In addition, water draining from the Elvins chat pile in Elvins is high in dissolved zinc. During low flow periods, there is enough zinc in the drainage from the chat pile to cause toxic levels of zinc in Flat River Creek. Because compounds of zinc are generally soluble in neutral and acidic solution, zinc is readily transported in most natural waters and is one of the most mobile of the heavy metals. Hardness, dissolved oxygen, temperature and synergistic (more than the sum of the individual components) effects with other compounds all affect the toxicity of zinc to aquatic life¹. Zinc is an essential nutrient to aquatic and terrestrial organisms, but in excess can be highly toxic and has the

¹ Upper Sacramento River TMDL for Metals, California Environmental Protection Agency, 9/25/01.
www.swrcb.ca.gov/rwqcb5/TMDL/upperSacCdCuZn.html

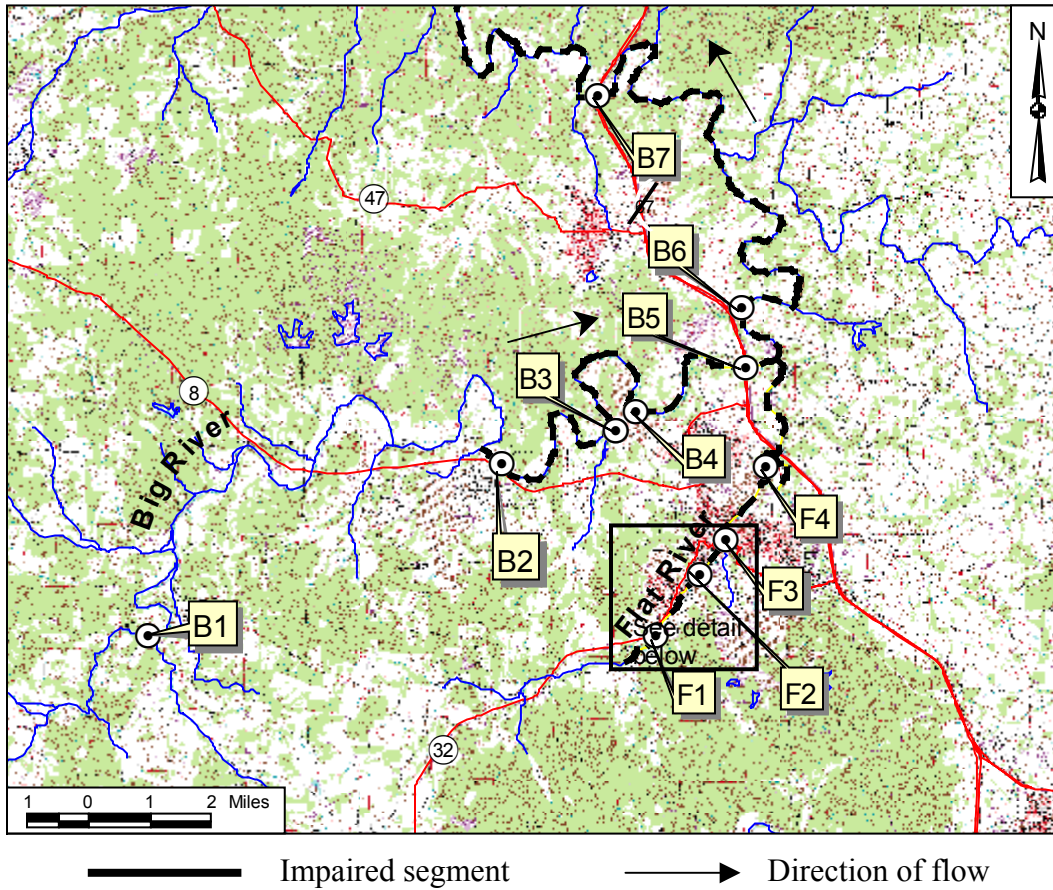
tendency to bioaccumulate (build up in organisms) in the environment. A number of behavioral and physiological effects have been reported when test organisms have been exposed to increased zinc levels. Behavioral responses in fish include avoidance and changes in feeding rate and movement patterns. Physiological changes in fish include increased ventilation rates, frequency of coughing and a decrease in oxygen utilization.²

Map Showing Location of Flat River Creek and Big River



² Red Clay Creek TMDL, Delaware Natural Resources and Environmental Control, 8/1/99.
www.dnrec.state.de.us/DNREC2000/Library/Water/rcctmdl.pdf

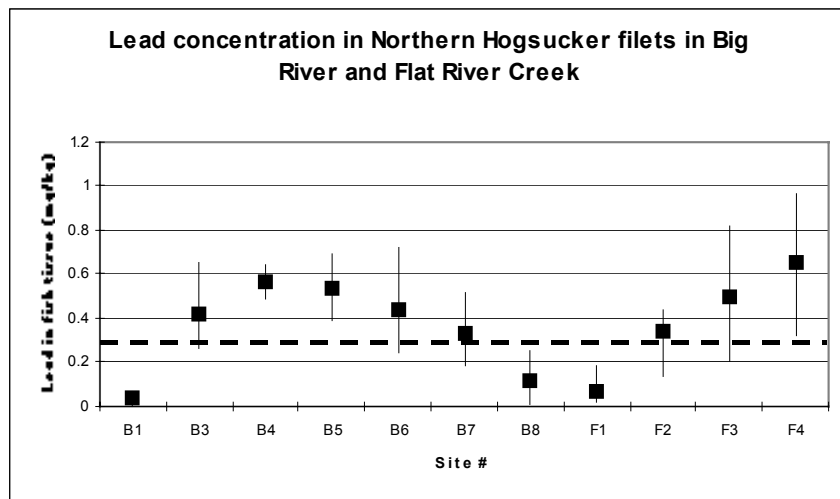
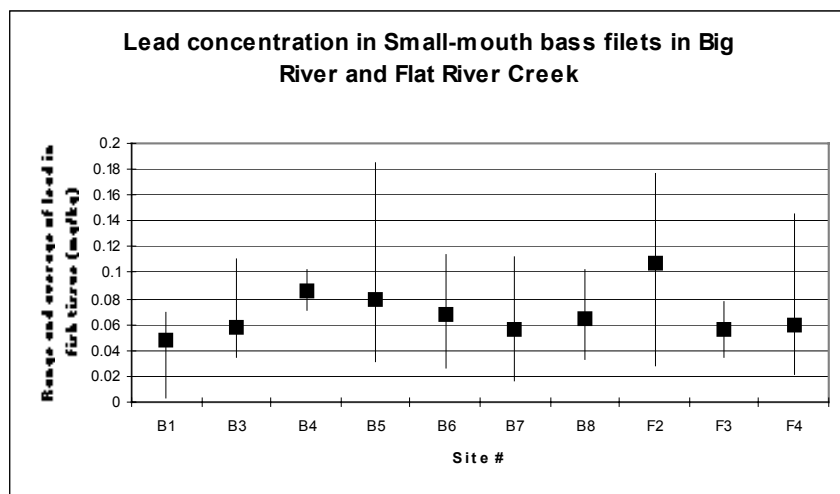
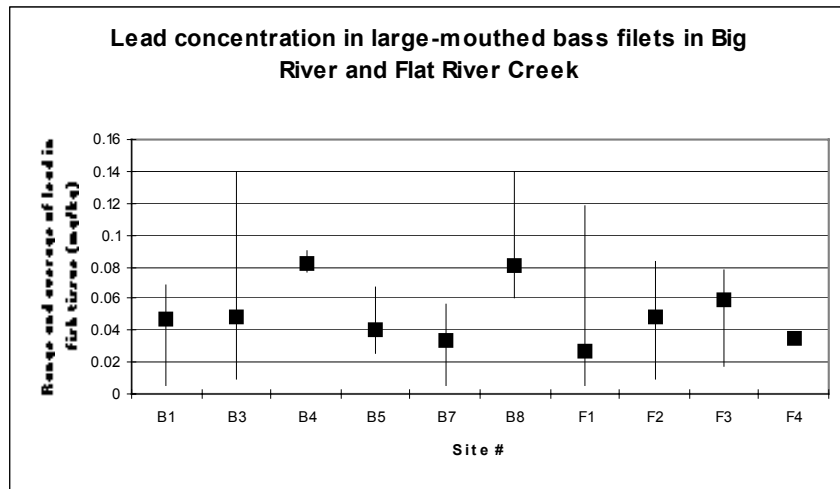
Map Detailing Sampling Sites for Big River and Flat River Creek



Sample Site Index

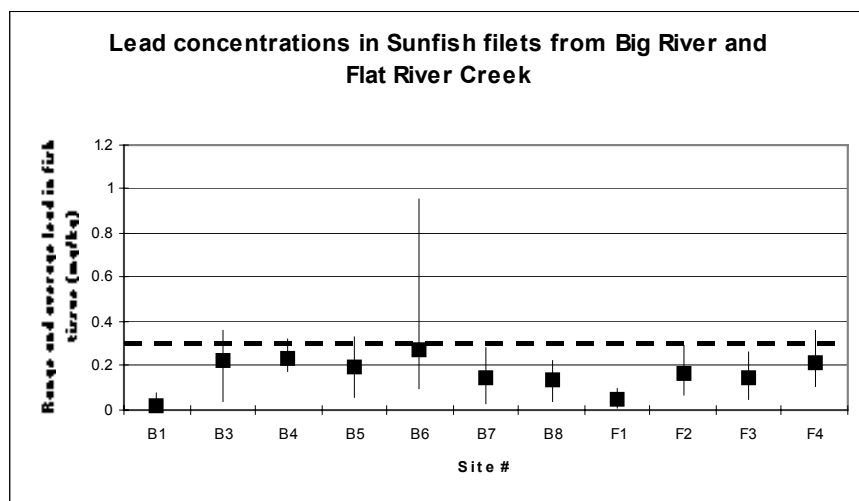
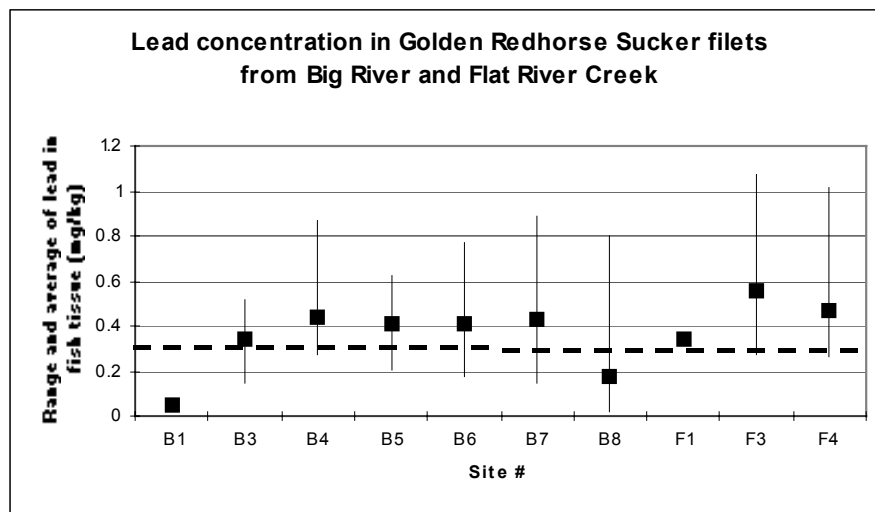
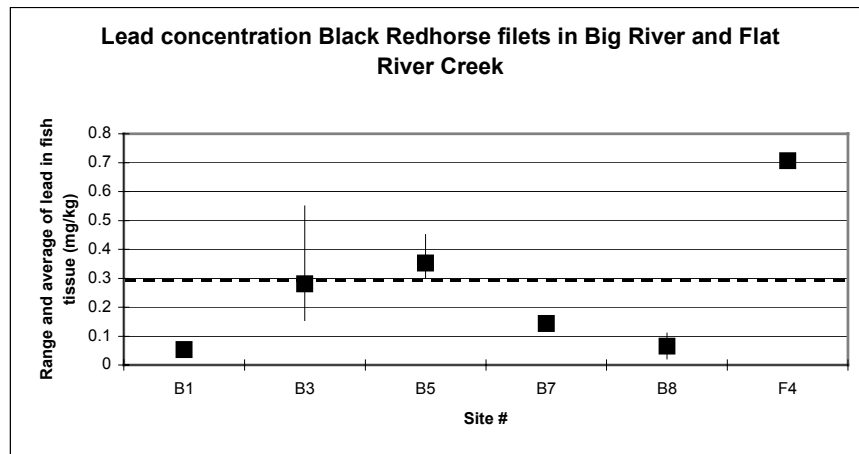
- B1 – Big River at Irondale
- B2 – Big River at Leadwood access
- B3 – Big River at Bone Hole
- B4 – Big River at East end of Desloge tailing pile
- B5 – Big River below Desloge
- B6 – Big River 1.2 miles below Flat River Creek
- B7 – Big River 11.7 miles below Flat River Creek

- F1 – Flat River Creek at Derby
- F2 – Flat River Creek just below Elvins tailing pile tributary
- F3 – Flat River Creek at Main Street, Flat River
- F4 – Flat River Creek below National chat pile



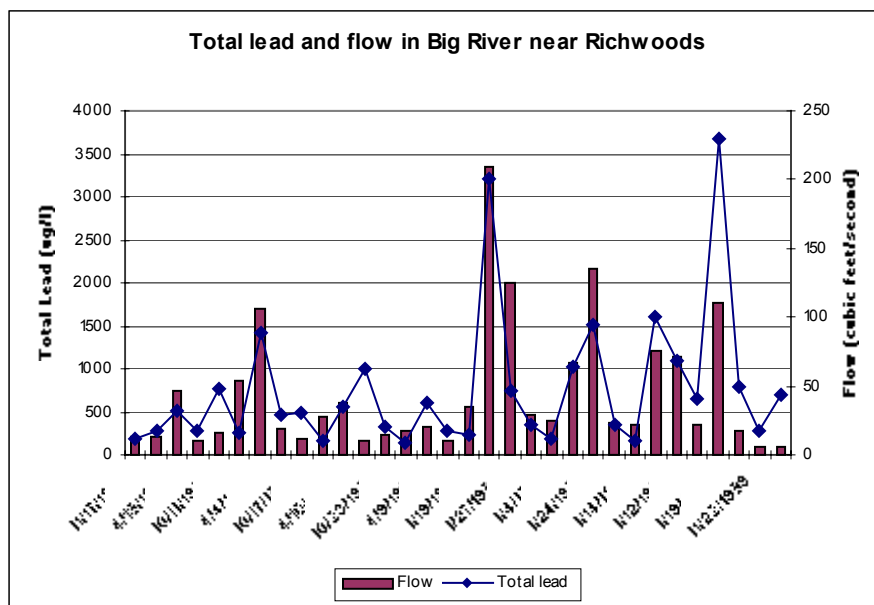
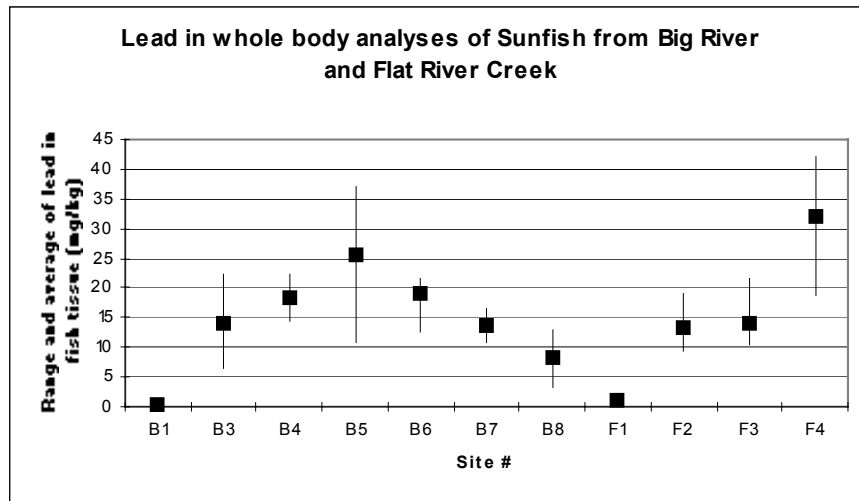
----- Dashed line equals 0.3 mg/kg, the maximum recommended lead concentration in fish to be consumed (World Health Organization).

Source: Dr. Gary Patterson, University of Missouri, Rolla



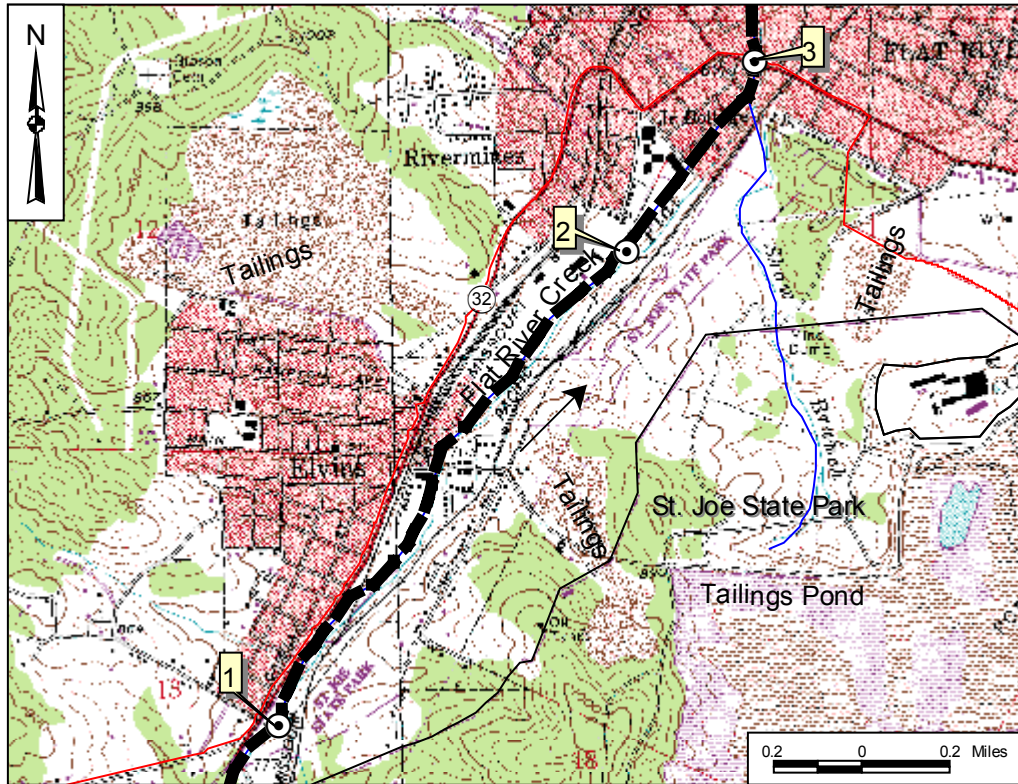
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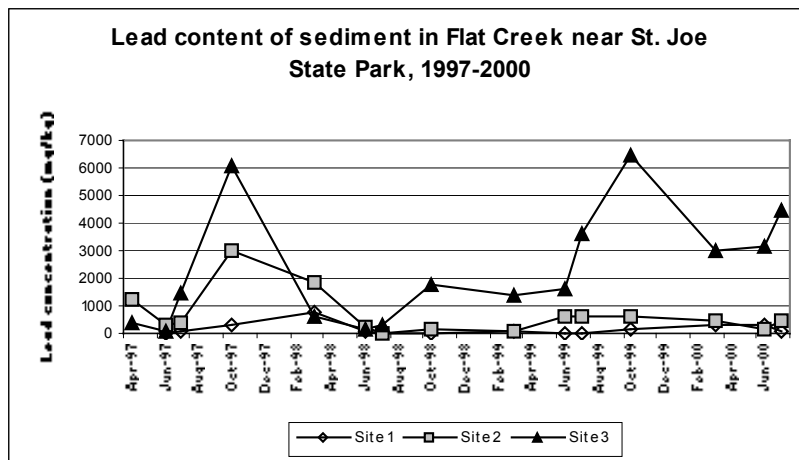
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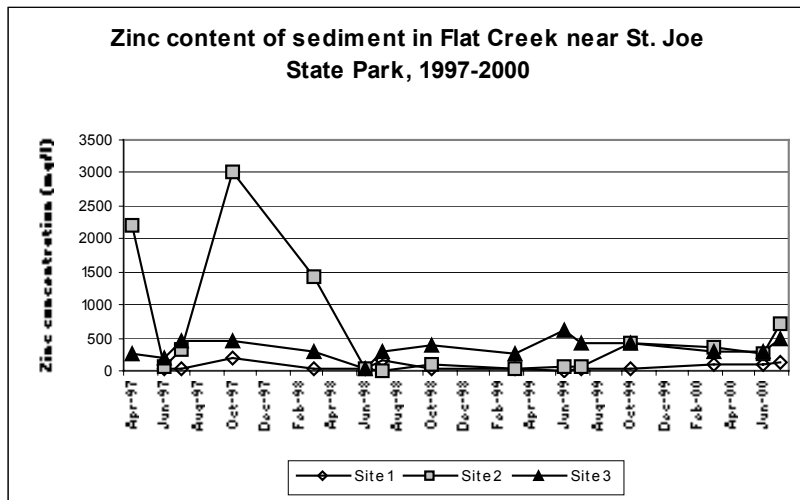
Map Showing Impaired Segment of Flat River Creek



--- Impaired Segment → Direction of flow

Site Index	
1	Flat River Creek at Hwy B
2	Flat River Creek at Rivermines
3	Flat River Creek at Main Street, Flat River





Source: Missouri Department of Natural Resources, Division of State Parks

For more information call or write:

Missouri Department of Natural Resources

Water Pollution Control Program

P.O. Box 176, Jefferson City, MO 65102-0176

1-800-361-4827 or (573) 751-1300 office

(573) 751-9396 fax

Program Home Page: <http://www.dnr.state.mo.us/wpscd/wpcp/index.html>